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ESTABLISH BASELINE VEGETATION CHARACTERISTICS FOR LONG-TERM MONITORING OF VEGETATION CHANGES IN THE PROPOSED JACK SPRINGS PINYON RESEARCH NATURAL AREA. Dr. Robert S. Nowak

FINAL REPORT

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TITLE: Establish Baseline Vegetation Characteristics for Long-Term Monitoring of Vegetation Changes in the Proposed Jack Springs Pinyon Research Natural Area.

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Introduction

Pinyon-juniper woodlands cover about 7.1 million ha (17.6 million ac) in the Great Basin (Tueller and others 1979), or about 17 percent of the area. Because of their wide distribution in the Great Basin, they represent a wide range of community types. West and others (in press) have divided the Great Basin into nine geographic regions based upon similar environment and community structure. Management of each of these regions requires understanding of their particular dynamics. Monitoring of the vegetation in Research Natural Areas representative of each of these regions can provide important ecological and management information. Because of their rarity, and particularly important for the understanding of pinyon-juniper woodlands, is the study of stands that escaped disturbance during the settlement of the region.

Establishment of the new Jack Springs Pinyon Research Natural Area is nearing completion. This RNA is located on the southwestern corner of the Bridgeport District of the Humboldt-Toiyabe National Forest. It is east of Mono Lake and about ten kilometers (five miles) into Nevada from the California State line. This RNA is representative of the geographic region located on the western edge of the Great Basin. This region has large areas of pure pinyon woodlands occurring on the western edge of Nevada and in southeastern California. This new RNA was established to replace a previous RNA established many years ago that was destroyed by trespass wood cutting and ORV use.

The new RNA is in a much more isolated area with difficult access. The mostly pure pinyon woodlands on this site were largely undisturbed during European settlement and the majority of them represent old growth as defined by Miller and others (in press). Despite the

majority of old-growth, successional stands representing a full range of tree age classes and sagebrush dominated communities are also present. Surrounding the RNA are also many square kilometers with the same community composition and patterns of tree age and dominance.

Because of limited accessability and limited access to water, grazing in the past was light and ended in the late 1940's. With the absence of important mineral resources, no mining has occurred in the area. For these many reasons, the Jack Springs RNA represents a unique opportunity to study the dynamics of old, established woodlands for comparison with the extensive areas of post-settlement stands that now comprise about 2/3 of the woodlands in the Great Basin (Tausch and others 1981, Tausch in press).

This study was implemented to establish permanent plots from which full inventories of plant species composition can be obtained and monitored. These inventories will provide the baseline data necessary for the long-term monitoring of successional patterns, stand dynamics, and associated vegetation changes on the RNA. An important part of these data will be to permit descriptions and explanations of the spatial and temporal dynamics that can be used in the management of other areas.

Methods

Aerial photos for the Jack Springs RNA were obtained from the Bridgeport District files. Two dates of photos were located, one for June, 1940 and one for July 1993. Enlargements of these photos were used in combination with ground reconnaissance to do a preliminary identification of the major community types and tree age classes within the area. Representative sites within these identified communities were then selected for establishment of the permanent plots. Seventeen plots representing a majority of the identified communities

and successional conditions were established and initial vegetation data collected during the summer of 1997. Additional sampling is planned for the summer of 1998.

Field Sampling

Each permanent macroplot established is 20 by 50 meters in size with the long axis running up slope. The lower end is marked by a 1.8 meter (six foot) tall fence post and the upper end, 50 meters from the fence post, is marked with reinforcing bar approximately 30 cm (1 ft) tall. Physiographic features recorded at each macroplot location were: elevation, slope, aspect, length of slope, position on slope, landform, and macro- and micro-relief. Each plot was located and mapped on the appropriate aerial photo.

For vegetation sampling, a 50 meter tape was strung between the fence post and the re-bar. Another tape was used at each end to locate the corners 10 meters on either side of the center-line. Each tree rooted within the full 20 by 50 meter plot was measured for the longest crown diameter, the diameter perpendicular to the longest, total tree height, the height of the crown with foliage, and the basal circumference. Crown measurements were to the nearest decimeter for trees more than a meter tall and to the nearest centimeter for smaller trees. Basal diameter measurements were in centimeters.

Percent crown cover for the understory shrub, grass and forb species was sampled on five transects, each 20 meters long, located perpendicular to, and centered on the 50 meter center-line tape. One 20 meter cross transect was randomly located within each 10 meter section of the centerline tape. Each transect was sampled in 10 microplots, 1 by 2 meters in size, located contiguously along the transect. Percent cover was estimated by species to the nearest 0.5 percent using guides representing 0.5, 1.0, and 2.0 percent of the 1 by 2 meter microplot. Following transect sampling, the entire 20 by 50 meter plot was searched for any

plant species not encountered during the transect sampling and those found recorded as a trace amount. When plant species could not be identified in the field, samples were collected and placed in a plant press. These specimens were later identified in the lab.

In addition to adding to the number of permanent established plots during the summer of 1998, the development of stem maps for the tree species in each of the macroplots will begin in 1998. Each plot will also be searched for plant species not encountered during the 1997 sampling.

Data Analysis

Crown diameters measured for the trees were used to determine their individual crown area and these were summed for the total crown area for the sampled trees and converted to percent crown cover by species. Percent crown cover values for each understory species were averaged by transect and for the entire macroplot. Data were summed by plot across species for total tree, total shrub, total grass, total forb, total understory, and total plot vegetal cover. Regression analysis was used to compare total tree and total understory cover across the sampled plots.

Aerial photos were interpreted for three levels or categories of tree dominance and each category mapped for both 1940 and 1993. The three levels used were 1) open or sagebrush dominated with any visible trees present representing less than 1/4 of the relative vegetation cover of the site, 2) early successional woodland sites dominated by young trees that represented more than 1/4 of the relative vegetation cover of the site, and 3) woodland sites dominated by mature trees. No attempt was made at this time to separate the tree dominated sites by the age classes of the trees present. It is hoped it will be possible to add this level of resolution in the future.

Results

A total of 95 plant species were identified on the 17 plots sampled (Table 1, Fig. 1). Figure one also shows the outline of the Jack Springs Pinyon RNA, the elevational contours, and the locations of the seventeen macroplots sampled. There were a total of two tree, 12 shrub, 14 grass and 67 forb species sampled in the macroplots. Previous visits to the site as part of preparing the proposal for RNA status identified an additional 8 species (Table 2). All but one plot (14) had singleleaf pinyon (*Pinus monophylla*) as the only tree species present (Table 3). The one plot with Utah juniper (*Juniperus osteosperma*) had a single old individual. There were an average of 4 shrub species, 4 grass species, and 18 forb species in the 17 macroplots. The total number of plant species in the macroplots ranged f rom 14 to 41 with an average of 27 total species (Table 3).

Crown cover for the trees varied from a trace to over 68 percent and averaged 38 percent (Table 4). Shrub crown cover varied from less than one percent to over 20 percent and averaged 6.5 percent. Grass cover was generally low, ranging from less than 0.1 percent to nearly five percent and only averaging 0.5 percent. Cover for forbs was less than one percent in all but one plot, where it barely exceed that value, and averaged 0.3 percent cover. Total plot cover averaged 45 percent with a range from about 21 to nearly 70 percent (Table 4).

Regression analysis comparing total tree cover and total understory cover (Fig. 2) was similar to the results for these woodlands from other Great Basin locations (Tausch and others 1981, Tausch and West 1995). The maximum cover of the understory, in comparison to the maximum cover of the trees, was generally lower than found in the previous studies. For the Jack Springs Pinyon RNA the maximum understory cover in the absence of trees was less than 40 percent of the maximum tree cover sampled (Fig. 2).

Copies of the 1940 (Fig. 3) and 1993 (Figs. 4 and 5) aerial photographs for the RNA area reveal differences in the dominance of trees and the abundance of sagebrush dominated locations. The large areas of old-growth pinyon woodland that are dominant on the site are obvious from comparison of the two different photo dates. In 1940 the sagebrush dominant areas generally increased with increasing elevation from the northeast to the southwest. A small fire evident in the northeast corner in 1940 had become fully occupied by trees by 1993.

In the 1940 aerial photograph the areas that are dominated by sagebrush with less than 1/4 relative cover by trees were found on a total of 176 ha (437 ac), or 34 percent of the 1280 ha in the RNA (Fig. 6). The young tree category, areas where young trees dominated greater than 1/4 of the relative vegetation cover of the site, were found on a total of 49 ha (120 ac) or 9 percent of the total. Areas dominated by mature trees covered 293 ha (723 ac) in 1940, or 57 percent of the area of the RNA (Fig. 6). By 1993 the area in the open category had declined to 64 ha (157 ac), or 12 percent of the total area (Fig 7.). The area with 1/4 or more of the relative vegetation cover dominated by young trees had increased to 102 ha (254 ac), or about 20 percent of the RNA. Mature trees had increased to dominate 352 ha (869 ac), or about 68 percent of the total area of the RNA.

The expansion in the area dominated by trees in the RNA, and the reduction in the area dominated by sagebrush in 53 years, is consistent with pattern of tree expansion observed for the last 150 years throughout the Great Basin (Tausch and others 1981, Tausch and West 1995). While the site shows evidence of scattered small fires in the past, none seem to have occurred for about 100 years or more. The result has been steady invasion by trees into areas opened up by past disturbance, growth of trees in areas already invaded, and no addition of sagebrush dominated areas by more recent disturbance.

During sampling of the Jack Springs RNA two subspecies of sagebrush were observed

dominating the open areas and the understory in tree dominated areas. Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) dominated in the lowest elevation areas in the northeast corner of the RNA. This amounted to about 25 percent of the total area of the RNA (area A, Fig. 8). In the remainder of the RNA, the open areas and the understory in tree dominated areas was dominated by mountain big sagebrush (*Artemisia tridentata vaseyana*). Across mid-elevation locations dominated by both Wyoming and mountain big sagebrush, basin big sagebrush (*Artemisia tridentata tridentata*) was a scattered sub-dominant.

Literature Cited

Miller, R,; Tausch, R.J.; Waichler, W. In Press. Old-growth juniper and pinyon woodlands. In: Monson, Stephen B.; Stevens, Richard; Tausch, Robin J.; Miller, Rick; Goodrich, Sherel. 1998. Procedings: ecology and management of pinyon-juniper communities within the interior west. 1997 Sept. 15-18, Provo, UT. Gen Tech Rep. RMRS-GTR-000. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Tausch, Robin J. In Press. Historic pinyon and juniper woodland development. In: Monson, Stephen B.; Stevens, Richard; Tausch, Robin J.; Miller, Rick; Goodrich, Sherel. 1998. Procedings: ecology and management of pinyon-juniper communities within the interior west. 1997 Sept. 15-18, Provo, UT. Gen Tech Rep. RMRS-GTR-000. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Tausch, R.J.; West, N.E.; and Nabi, A.A. 1981. Tree age and dominance patterns in Great Basin pinyon-juniper woodlands. J. Range Manage. 34:259-264.

Tausch, R.J.; and West, N.E. 1995. Plant species composition patterns with differences in tree dominance on a southwestern Utah pinyon-juniper site. In: D.W. Shaw, E.F.

Aldon, C. LoSapio, Coords. Desired future conditions for pinyon-juniper ecosystems; 1994 August 8-12; Flagstaff, AZ. Gen Tech. Rep. RM-GTR-258. Fort Collins, CO; USDA Forest Service, Rocky Mountain Forest and Range Experiment Station: 16-23.

Tueller, P.T.; Beeson, C.D.; Tausch, R.J.; West, N.E.; Rae, K.H. 1979. Pinyon-juniper woodlands of the Great Basin: distribution, flora, vegetal cover. USDA Forest Service Res. Paper INT-229.

West, N.E., Tausch, R.J., and Tueller, P.T. In Press. A management oriented classification of pinyon-juniper woodlands of the Great Basin. Gen Tech Rep. RMRS-GTR-???. Ogden, UT; USDA Forest Service, Rocky Mountain Research Station.

Table 1. Plant species sampled by tree, shrub, grass and forb and their percent vegetal cover values for 17 plots on the Jack Springs Pinyon Research Natural Area, Nevada.

Species Name	Species	Species Cross #	Species #	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
Trees								
Pinus monophylla	Pin mon	68	1	27.567	41.032	0.001	57.225	42.069
Juniperus osteosperma	Jun ost	69	2	0	0	0	0	0
Total				27.567	41.032	0.001	57.225	42.069
Shrubs								
Artemisia tridentata tridentata	Art tri	84	3	0	0	5.261	0	0
Artemisia tridentata vaseyana	Art vas	85	4	0	5.08	10.97	0.51	0
Artemisia tridentata wyomingensis	Art wyo	86	5	6.47	0	0	0	1.061
Eriogonum microsecrum	Eri mic	87	6	1.004	0	0	0	0.001
Chrysothamnus viscidiflorus	Chr vis	88	7	0.2	0	0.94	0	0.05
Ephedra viridis	Eph vir	89	8	0.61	0	0	0	0
Leptodactylon pungens	Lep pun	91	9	0.001	0	0.001	0	0
Opuntia species	Opuntia spp.	92	10	0	0	0	0.14	0.13
Purshia tridentata	Pur tri	94	11	3.467	1.353	3.351	0.001	0.22
Ribes velutinum	Rib vel	95	12	0	0.44	0	0.34	0
Salvia dorrii	Sal dor	96	13	0	0	0	0	0.406
Tetradymia glabrata	Tet gla	97	14	0	0	0.001	0	0
Total				11.752	6.873	20.544	0.991	1.868
Grasses								
Agropyron smithii	Agr smi	70	15	0	0	0	0	0
Bromus tectorum	Bro tec	71	16	0	0	0	0	0.001
Elymus cinereus	Ely cin	72	17	0	0	0	0	0
Hybrid: Ely cin & Si hy	Hybrid	73	18	0	0	0.14	0.022	0
Koeleria nitida	Koe nit	74	19	0	0.001	0	0.001	0
Melica stricta	Mel str	75	20	0	0.001	0	0	0
Oryzopsis hymenoides	Ory hym	76	21	0	0.04	0.03	0.11	0.001
Poa fendleriana	Poa fen	77	22	0	0	0	0.001	0
Poa secunda secunda	Poa sec	78	23	0	0.03	0	0.07	0.02
Sitanion hystrix	Sit hys	79	24	0.297	0.122	0.04	0	0.178
Stipa comata	Sti com	80	25	0	0	0	0	0.001
Stipa occidentalis	Sti occ	81	26	0	0.01	0.29	0	0
Stipa thurberiana	Sti thu	82	27	0.201	0.037	0.02	0.205	0.121
Stipa webberii	Sti web	83	28	0	0	0	0	0.02
Total				0.498	0.239	0.5	0.41	0.342

Forbs								
Allium nevadense	All nev	1	29	0	0.001	0	0	0.001
Arabis holboellii	Ara hol	2	30	0.013	0.005	0.001	0.015	0.001
Arabis puberula	Ara pub	3	31	0	0	0	0	0.001
Arabis sparsiflora	Ara spa	4	32	0	0	0	0.001	0
Arabis species	Arabis spp.	5	33	0	0	0	0	0
Arenaria kingii	Are kin	6	34	0.005	0.001	0	0	0.016
Aster scopulorum	Ast sco	7	35	0	0.001	0	0	0
Astragalus caseii	Astrag cas	8	36	0.026	0	0	0	0
Astragalus malacus	Astrag mal	9	37	0.001	0.026	0	0	0.001
Astragalus species	Astrag spp.	10	38	0	0	0	0.011	0
Calachortus species	Calachortus	11	39	0	0	0	0	0
Castilleja chromosa	Cas chr	12	40	0	0	0	0	0.001
Chaenactis douglasii	Cha dou	13	41	0.011	0.001	0	0	0.001
Chaenactis stevioides	Cha ste	14	42	0.001	0	0	0	0
Chenopodium album	Che alb	15	43	0	0	0.001	0	0
Chenopodium species	Chenopod spp	16	44	0	0	0	0	0
Chorizanthe brevicornu	Cho bre	17	45	0	0	0	0	0
Chorizanthe watsonii	Cho wat	18	46	0	0	0	0	0
Collinsia parviflora	Col par	19	47	0	0.001	0	0	0
Crepis accuminata	Cre acc	20	48	0	0.001	0	0	0
Cryptantha circumscissa	Cry cir	21	49	0	0	0	0.001	0.001
Cryptantha pterocarya	Cry pte	22	50	0.001	0.001	0.001	0.001	0.001
Cryptantha utahensis	Cry uta	23	51	0	0.001	0	0	0
Cryptantha watsonii	Cry wat	24	52	0	0	0	0	0
Delphinium andersonii	Del and	25	53	0	0.002	0	0	0
Descurainia pinnata	Des pin	26	54	0	0	0	0	0
Eriastrum wilcoxii	Eri wil	27	55	0.001	0	0	0	0.001
Erigeron aphanactis	Eri aph	28	56	0.001	0.002	0	0.001	0.007
Eriogonum caespitosum	Eri cae	29	57	0.001	0.001	0	0	0
Eriogonum ovalifolium	Eri ova	30	58	0.001	0	0	0	0.001
Eriogonum umbellatum	Eri umb	31	59	0.33	0.001	0	0	0
Eriogonum species	Eriogonum sp	32	60	0	0	0.001	0	0
Eriophyllum pringlei	Eriop prin	33	61	0	0	0	0	0
Gayophytum decipiens	Gay dec	34	62	0	0	0	0	0
Gayophytum diffusum	Gay dif	35	63	0	0	0	0	0

Gayophytum racemosissimum	Gay rac	36	64	0	0.001	0.121	0.001	0
Gayophytum species	Gay spp.	37	65	0	0.001	0	0.001	0.001
Gilia inconspicua	Gil inc	38	66	0	0.001	0	0.001	0.001
Gilia inyoensis	Gil iny	39	67	0	0.001	0	0.001	0.002
Gilia tenerrima	Gil ten	40	68	0	0	0	0	0
Gilia violacea	Gil vio	41	69	0	0	0	0.001	0.001
Gymnosteris parvula	Gym par	42	70	0	0	0	0	0
Linanthus septentrionalis	Lin sep	43	71	0.001	0.001	0	0.001	0.001
Lomatium foeniculaceum	Lom foe	44	72	0.001	0.001	0	0	0
Lomatium species	Lomatium spp.	45	73	0	0	0	0	0
Lupinus argenta	Lup arg	46	74	0	0	0	0	0
Lygodesmia spinosa	Lyg spi	47	75	0	0	0	0	0
Machaeranthera canescens	Mac can	48	76	0	0.001	0	0	0.001
Mentzelia congesto	Men con	49	77	0.001	0.001	0.001	0.001	0.001
Mimulus densus	Mim den	50	78	0	0	0.001	0.001	0
Mimulus nanus	Mim nan	51	79	0.001	0.001	0	0	0
Navarretia septentrionalis	Nav sep	52	80	0	0	0	0	0
Navarretia breureri	Nav bre	53	81	0	0	0	0	0
Orobanche fasciculata	Oro fas	54	82	0	0	0	0	0
Oxytheca dendroidea	Oxy den	55	83	0	0.001	0.001	0	0
Penstemon patens	Pen pat	56	84	0	0	0	0.001	0.001
Penstemon species	Penstemon sp	57	85	0.001	0	0	0	0.001
Phacelia curvipes	Pha cur	58	86	0	0.011	0	0	0
Phacelia fremontii	Pha fre	59	87	0	0.001	0.001	0.001	0
Phacelia vallis	Pha val	60	88	0	0.001	0	0.001	0.001
Phacelia species	Phacelia spp.	61	89	0	0	0	0	0
Phlox austromontane	Phl aus	62	90	0.681	0.01	0	0	0.1
Phlox longifolia	Phl lon	63	91	0.001	0.011	0	0.001	0.011
Senecio multilobatus	Sen mul	64	92	0.001	0.006	0.001	0.026	0
Zigadenus paniculatus	Zig pan	65	93	0	0	0	0	0
Senecio integerrimus	Sen int	66	94	0	0	0	0	0
Cryptantha species	Cryptan. sp.	67	95	0	0	0	0	0
Total				1.08	0.095	0.13	0.068	0.15

Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15	Plot 16	Plot 17
28.312	18.623	52.472	0.001	27.042	68.508	55.788	55.609	40.219	55.535	55.697	10.35
0	0	0	0	0	0	0	0	5.969	0	0	0
28.312	18.623	52.472	0.001	27.042	68.508	55.788	55.609	46.188	55.535	53.697	10.35
0	0	0.37	1.56	1.08	0	0	0	0	0	0	0.66
0	0	0.395	4.62	0.755	0.7	0.49	1.34	0	2.231	0.001	8.46
3.594	8.52	0	0	0	0	0	0	2.026	0	0	0
0	0.02	0.001	0	0	0	0	0	0.001	0	0	0
0	0.04	0	7	0	0	0	0	0	0	0	1.251
0.38	0	0.33	0	0	0.16	0.16	1.24	0	0.2	0	0.88
0.001	0	0	0	0.01	0	0	0	0	0	0	0.851
0	0	0	0	0	0	0.14	0	0	0.001	0.001	0
3.031	3.851	0.001	6.416	0.662	0	0.001	0	0.001	0.041	0.54	4.002
0	0	0	0	0.001	0	0.001	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0.42
7.032	12.431	1.097	19.596	2.508	0.86	0.792	2.58	2.028	2.473	0.542	16.704
0	0	0	2.762	0	0	0	0	0	0	0	0
0.001	0.001	0.001	0	0	0	0	0	0	0	0	0
0	0	0	2.05	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0.035	0	0.07	0	0.04	0
0	0	0	0	0	0	0	0	0	0.005	0	0
0	0	0	0.065	0.001	0	0	0	0.001	0.126	0	0
0	0	0	0	0	0	0.005	0	0.05	0	0.005	0
0	0	0	0	0	0	0.105	0.02	0.055	0	0.001	0
0.127	0.616	0.018	0	0.073	0.016	0.052	0.042	0.038	0.033	0.018	0.005
0	0	0	0	0.01	0	0	0	0	0.001	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0.005	0	0.005	0	0	0.02	0.046	0	0.051	0	0.006	0.001
0.01	0	0	0	0	0	0	0	0	0	0.005	0
0.143	0.617	0.024	4.901	0.084	0.036	0.243	0.062	0.266	0.165	0.075	0.006

0	0.001	0	0	0	0	0	0	0	0	0.001	0
0.012	0.007	0.047	0.001	0.011	0.057	0.039	0.019	0.002	0.007	0	0.001
0	0	0	0	0	0	0	0	0	0	0	0
0	0.001	0.001	0	0.001	0	0.011	0	0	0	0.001	0
0	0.011	0	0	0.012	0	0	0	0	0	0	0
0	0	0	0	0.001	0	0	0	0.001	0	0	0
0	0.005	0	0	0	0	0	0	0.009	0	0.054	0
0	0	0	0	0	0	0	0	0	0	0	0.046
0.038	0.09	0.011	0	0	0.001	0	0.03	0.003	0	0	0
0	0	0	0	0.036	0	0	0	0	0	0	0
0.001	0	0	0	0.002	0	0	0	0.001	0	0.001	0
0	0.001	0	0	0	0	0	0.001	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0.001	0	0	0	0	0	0	0
0	0	0	0.002	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.001	0.001	0	0	0
0.001	0.001	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.001	0.001	0	0	0	0	0
0	0	0	0	0	0.001	0	0	0.001	0	0	0
0.001	0.001	0	0	0	0	0.051	0.001	0.003	0	0.014	0
0.001	0.12	0.014	0	0	0.018	0.027	0.003	0.003	0.001	0.015	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.016	0	0	0	0.001	0	0
0.001	0	0	0	0.046	0	0	0.01	0	0	0	0
0	0	0	0	0	0	0	0	0	0.002	0	0
0.005	0.001	0	0	0.001	0	0	0.001	0.002	0.001	0.001	0
0.01	0	0	0	0.01	0	0	0	0	0	0	0
0	0.001	0	0	0.06	0	0	0	0	0	0	0
0.001	0	0	0	0	0	0	0	0.001	0	0	0
0.001	0.005	0	0	0.141	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0.001	0
0.001	0	0	0	0.002	0	0	0	0.001	0	0	0
0.001	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0.007	0	0	0.004	0

0.001	0	0	0	0	0	0	0	0	0	0	0
0	0.004	0.039	0.128	0	0	0.061	0	0.006	0.001	0	0.001
0.001	0	0.002	0	0.003	0.031	0	0.001	0.001	0.001	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.001	0	0	0	0	0	0
0	0	0	0	0	0	0.002	0	0	0	0	0
0	0	0	0	0	0.001	0	0.001	0.001	0	0	0
0.001	0	0	0	0.001	0.007	0.001	0	0.006	0	0.001	0
0	0.018	0.001	0	0.001	0	0	0	0	0	0	0
0	0	0	0	0.01	0	0	0	0.006	0	0	0
0	0	0	0	0	0.05	0	0	0	0	0	0
0.001	0.012	0	0	0	0	0	0.015	0	0	0	0
0	0.132	0	0	0	0	0	0	0	0.16	0	0.006
0	0.031	0.024	0	0.013	0.095	0.145	0.025	0.001	0.01	0.075	0.001
0.001	0	0	0.007	0	0	0	0	0	0	0.001	0
0.001	0	0.002	0	0.002	0	0	0	0	0	0	0
0	0	0	0	0.001	0	0	0.003	0.005	0	0	0
0	0	0	0	0	0	0	0	0.002	0	0	0
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0	0	0	0	0	0	0	0	0	0	0	0
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0.001	0.217	0.001	0.024	0.002	0.074	0	0.025	0.047	0	0	0
0	0	0	0.001	0	0	0	0.043	0	0	0	0
0	0.005	0	0	0.181	0	0.01	0.001	0.085	0	0.001	0.001
0.021	0	0	0.001	0	0.011	0	0	0.003	0	0	0
0	0	0	0	0	0	0	0.001	0	0.121	0	0
0	0	0	0	0.001	0	0	0	0.001	0	0	0
0	0	0	0	0.001	0	0.001	0	0	0	0	0
0.001	0	0.014	0	0.003	0	0.002	0.001	0.002	0	0.001	0
0.103	0.665	0.168	0.164	0.543	0.381	0.362	0.191	0.19	0.307	0.173	0.057

Table 2. Plant species sampled as part of the initial survey for the establishment of the Jack Springs Pinyon Research Natural Area but not encountered during sampling of the 17 plots listed in Table 1.

Scientific Name	Common Name
Artemisia arbuscula	Low sagebrush
Eriogonum wrightii	Wright buckwheat
Happlopappus acaulis	Stemless goldenweed
Mentzelia albicaulis	Whitestem mentzelia
Opuntia echinocarpa	Pale cholla
Penstemon speciosus	Showy penstemon
Phlox hoodii	Carpet phlox

Table 3. Number of tree, shrub, grass, and forb species and total species in 17 plots sampled on the Jack Springs Pinyon Research Natural Area.

Plot Number	Tree	Shrub	Grass	Forb	Total
1	1	6	2	20	29
2	1	3	7	30	41
3	1	6	5	10	22
4	1	4	6	19	30
5	1	6	7	24	38
6	1	4	4	22	31
7	1	4	2	21	28
8	1	5	3	12	21
9	1	3	3	7	14
10	1	5	3	25	34
11	1	2	2	15	20
12	1	5	5	14	25
13	1	3	6	21	31
14	2	3	6	26	37
15	1	4	4	11	20
16	1	3	6	15	25
17	1	7	2	7	17

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7	1	4	2	21	28
8	1	5	3	12	21
9	1	3	3	7	14
10	1	5	3	25	34
11	1	2	2	15	20
12	1	5	5	14	25
13	1	3	6	21	31
14	2	3	6	26	37
15	1	4	4	11	20
16	1	3	6	15	25
17	1	7	2	7	17

Table 4. Vegetal cover for total tree, total shrub, total grass, total forb, total understory and total plot cover for the Jack Springs Pinyon Research Natural Area for 17 sampled plots.

Plot #	Tree Total	Shrub Tot.	Grass T.	Forb T.	Under T.	Plot T.
1	27.57	11.75	0.50	1.08	13.33	40.90
2	41.03	6.87	0.24	0.09	7.21	48.24
3	0.001	20.54	0.50	0.13	21.47	21.47
4	57.23	0.99	0.41	0.07	1.47	58.69
5	42.07	1.87	0.34	0.15	2.36	44.43
6	28.31	7.03	0.14	0.10	7.28	35.59
7	18.62	12.43	0.62	0.66	13.71	32.34
8	52.47	1.09	0.024	0.17	1.29	53.76
9	0.001	19.60	4.90	0.16	24.66	24.66
10	27.04	2.51	0.08	0.54	3.13	30.18
11	68.51	0.86	0.04	0.38	1.28	69.79
12	55.79	0.79	0.24	0.36	1.40	57.19
13	55.61	2.58	0.06	0.19	2.83	58.44
14	46.19	2.03	0.27	0.19	2.48	48.67
15	55.53	2.47	0.16	0.31	2.94	58.48
16	53.70	0.54	0.07	0.17	0.79	54.49
17	10.35	16.70	0.006	0.06	16.77	27.12

List of Figures

Figure 1. Map of the Jack Springs Pinyon Research Natural Area showing the border, topography, and locations of the 17 sampled plots.

Figure 2. Regression analysis results between the total tree vegetal cover and total understory vegetal cover.

Figure 3. Aerial photo of the Jack Springs Pinyon Research Natural Area from June, 1940 with the outline of the research natural area shown.

Figure 4. Aerial photo of the eastern half of the Jack Springs Research Natural Area from July, 1993 with the outline of the research natural area shown.

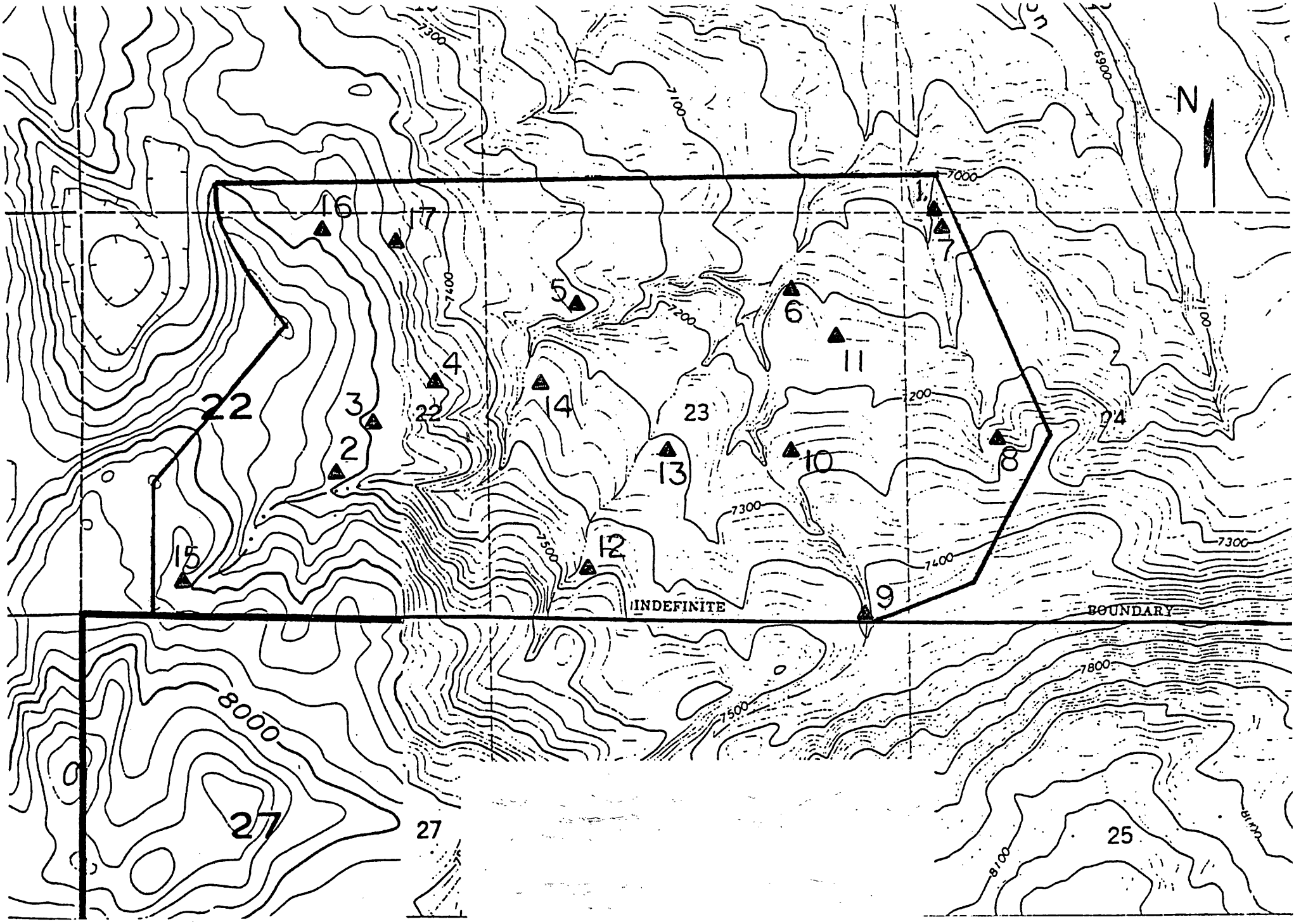
Figure 5. Aerial photo of the western half of the Jack Springs Research Natural Area from July, 1993 with the outline of the research natural area shown.

Figure 6. Locations of the portions of the June, 1940 aerial photograph showing the three categories of vegetation cover of 1) areas that were dominated by sagebrush, 2) areas that were dominated by young trees, and 3) areas that were dominated by mature trees.

Figure 7. Locations of the portions of the July, 1993 aerial photograph showing the three categories of vegetation cover of 1) areas that were dominated by sagebrush, 2) areas that

were dominated by young trees, and 3) areas that were dominated by mature trees.

Figure 8. A copy of Figure 7. showing the distribution of the subspecies of big sagebrush that dominates the non-tree vegetation. For the area indicated by 'A' the dominant subspecies is *Artemisia tridentata wyomingensis*. For the area indicated by 'B' the dominant subspecies is *Artemisia tridentata vasyana*.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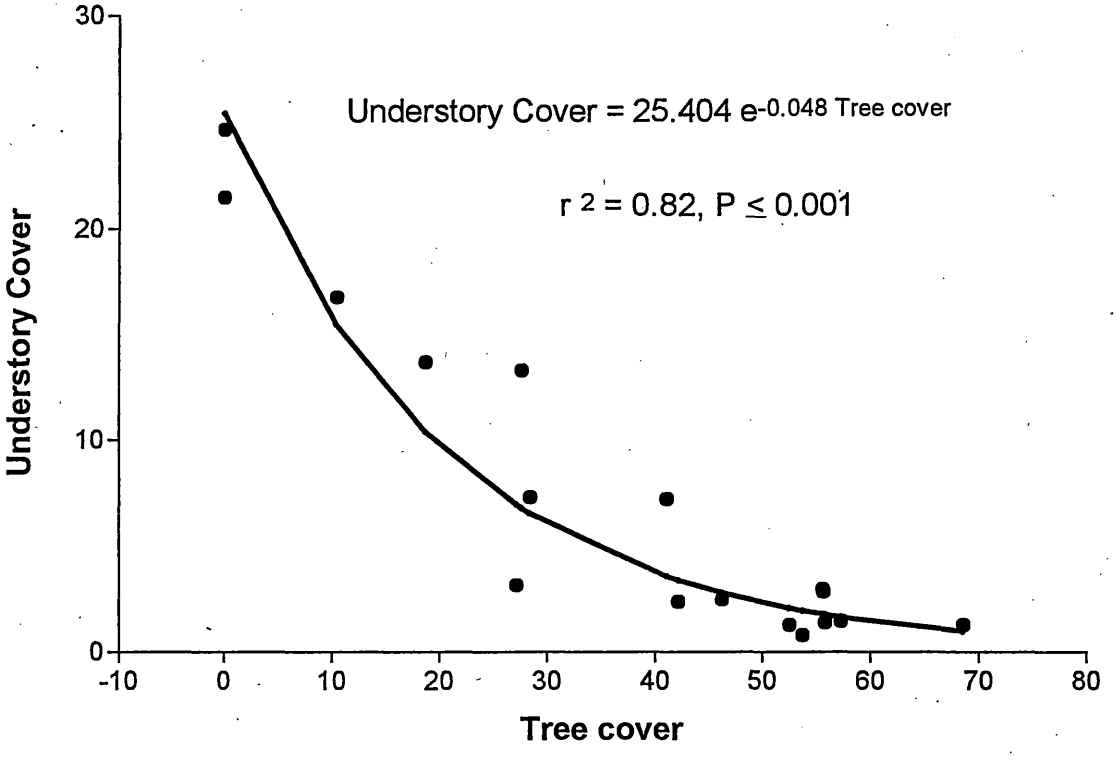
Regression of Understory Cover by Tree Cover



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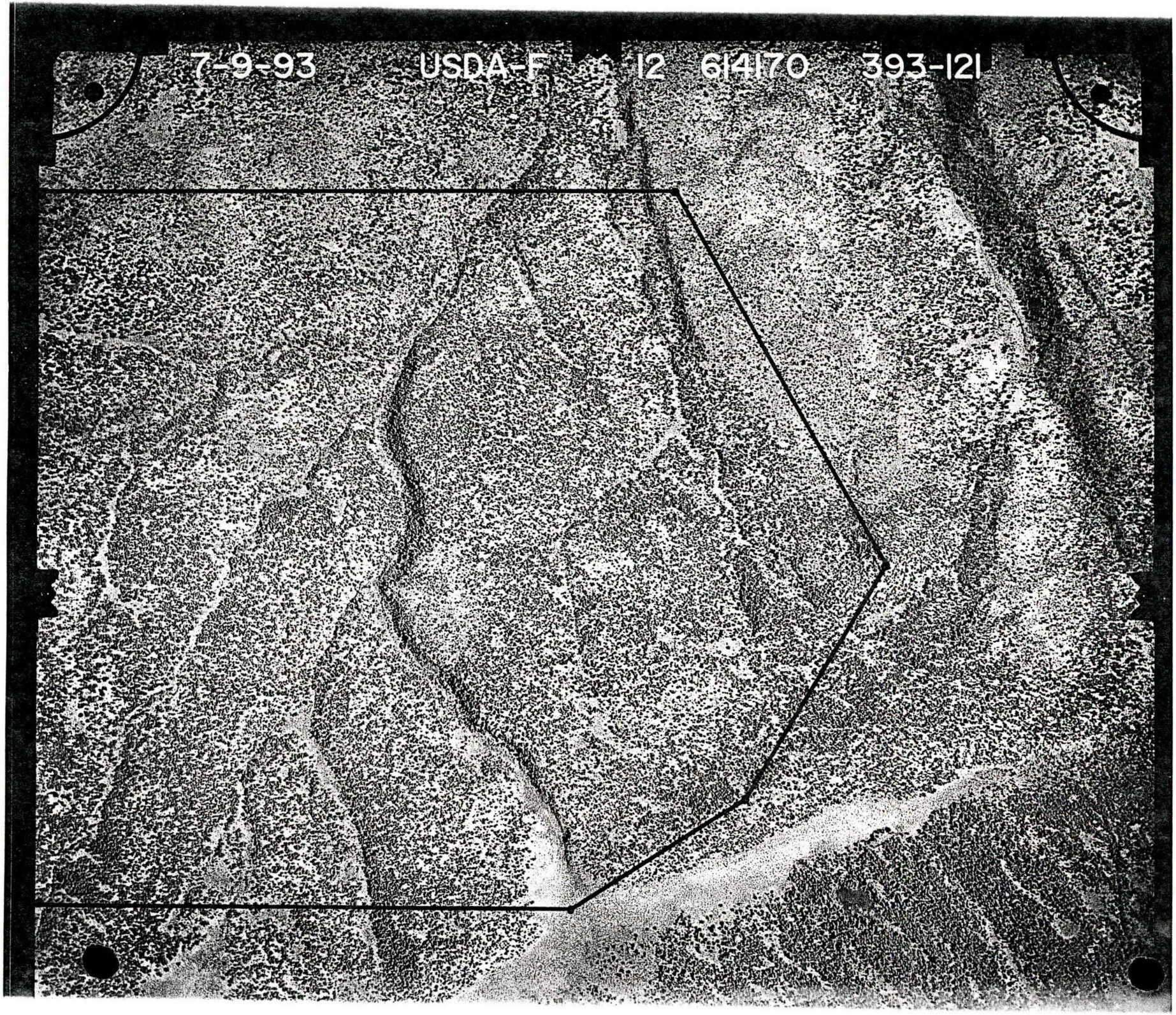
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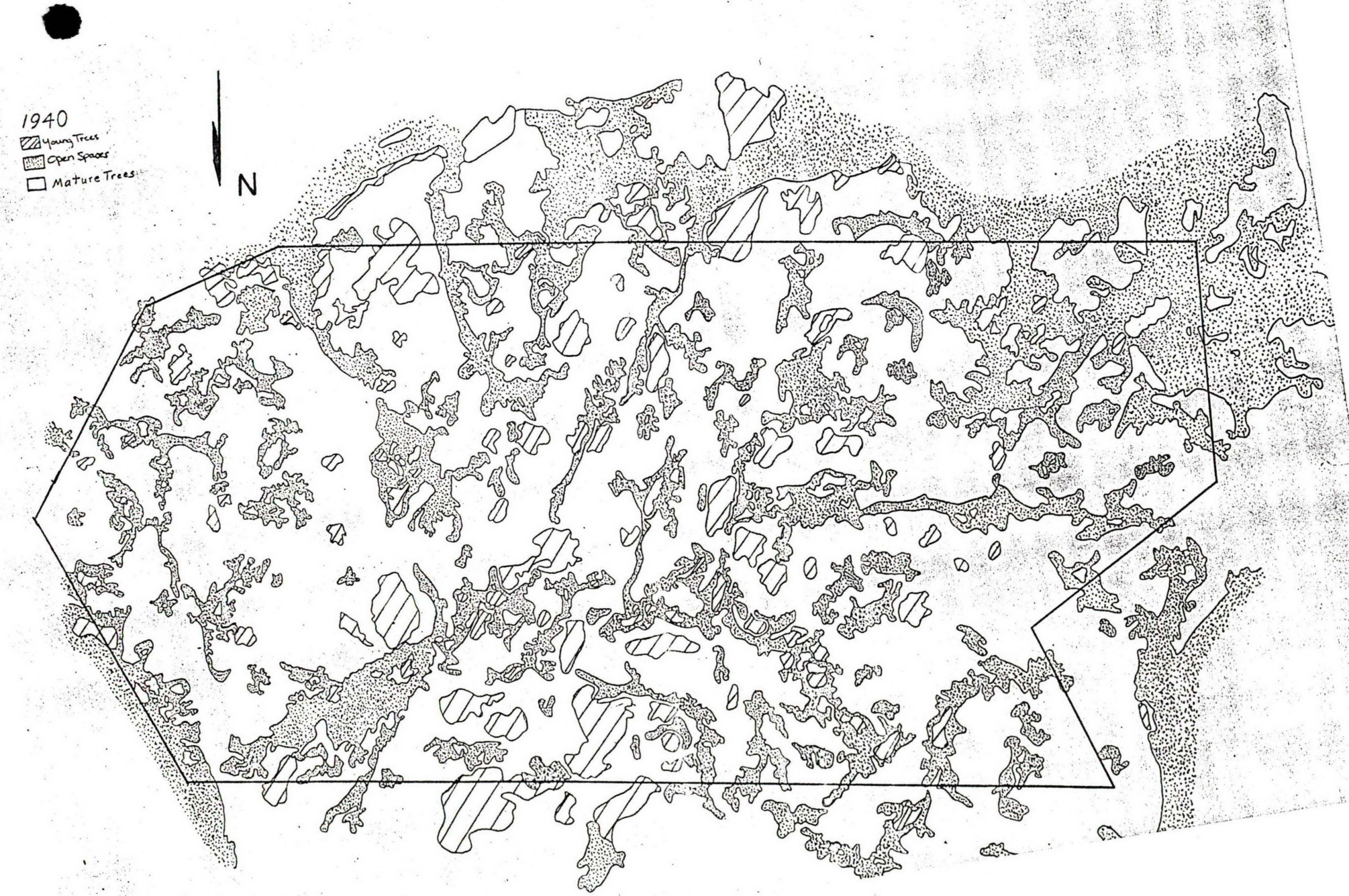
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Open Spaces
Mature Trees
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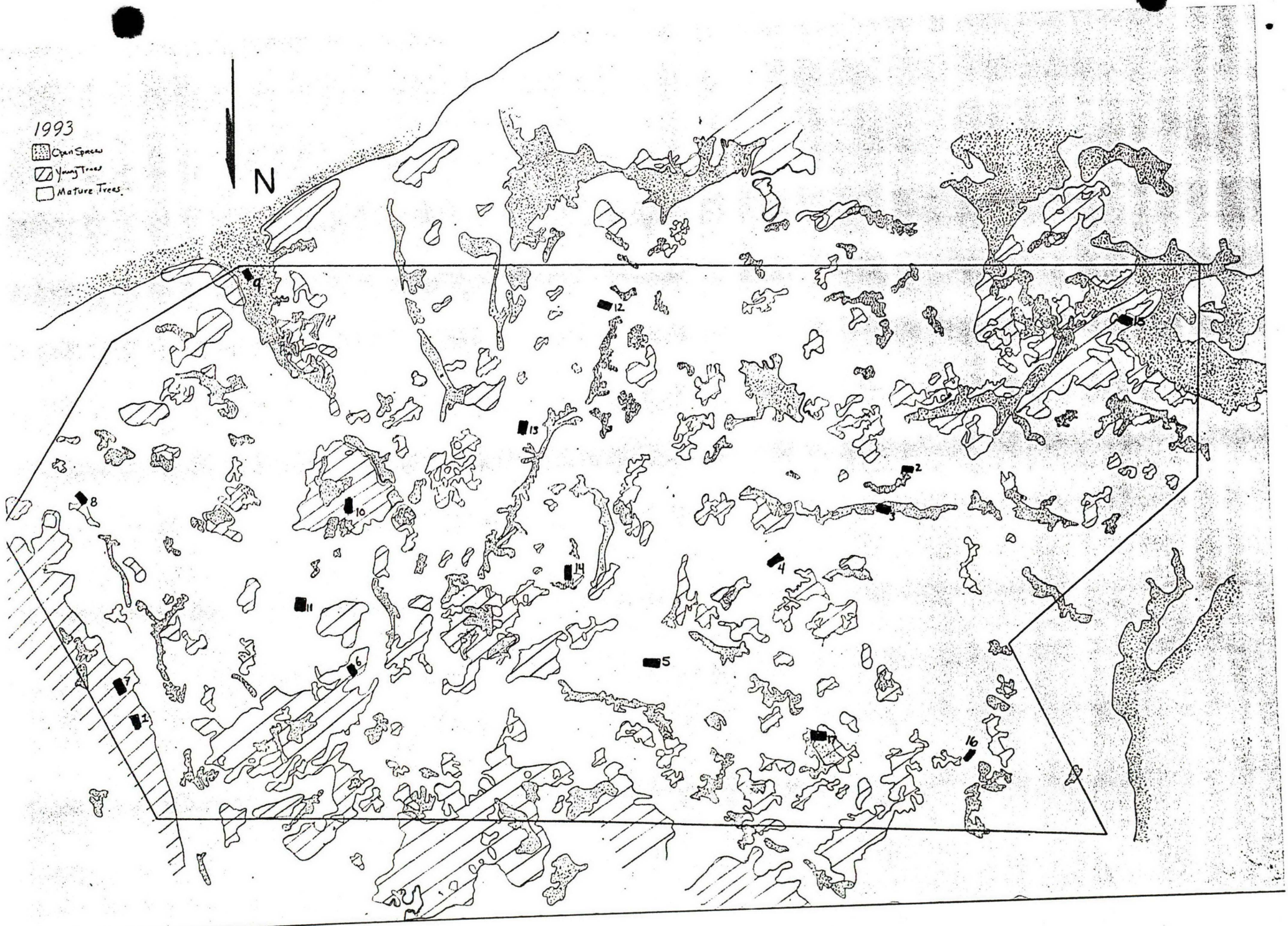
1993
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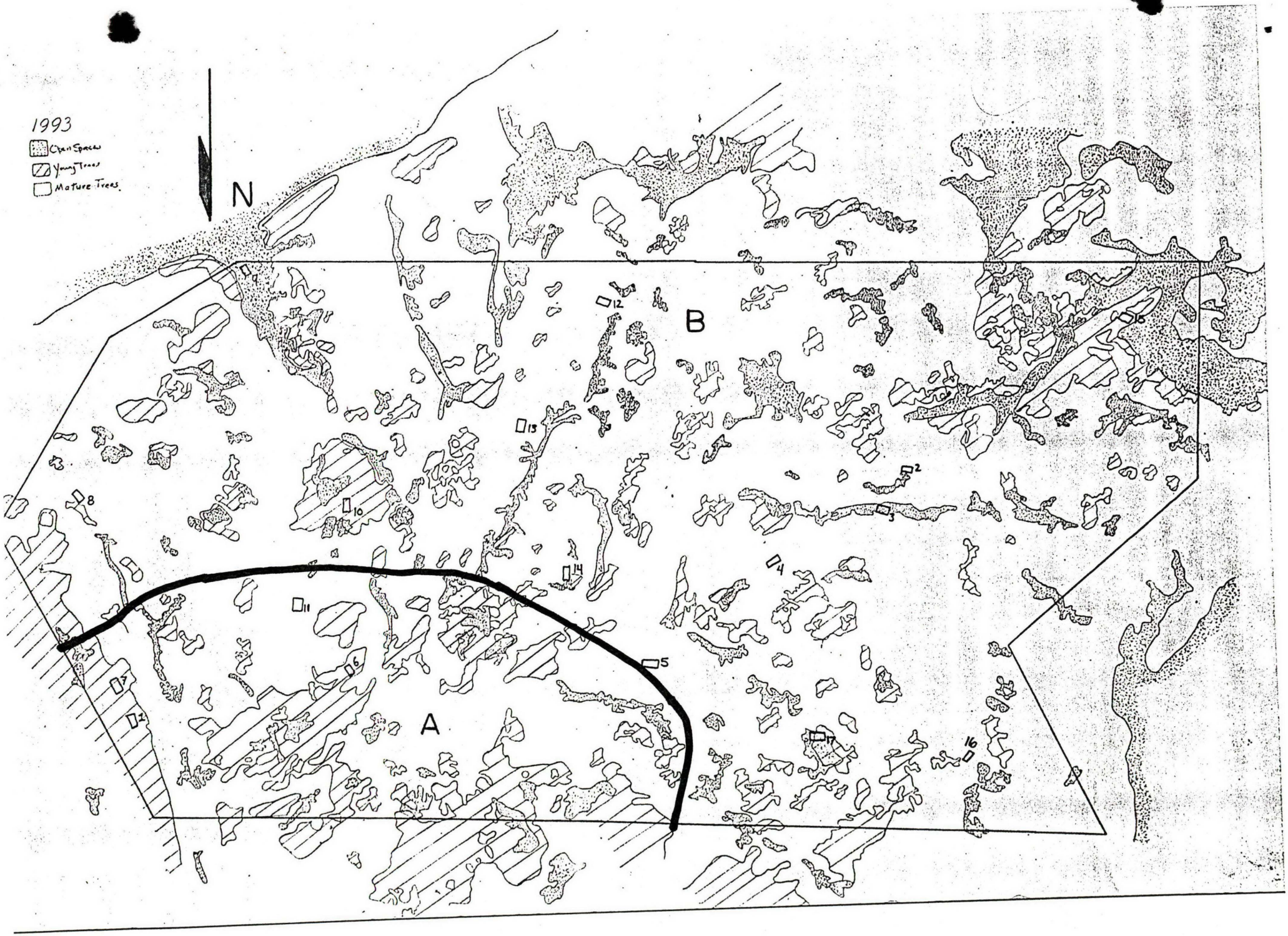
1993
Open Spaces
Young Trees
Mature Trees
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